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DISPLAY$4	0
DISPLAY	1380117
DISPLAYA	12
DISPLAYABEL	1
DISPLAYABIE	2
DISPLAYABLE	8088
DISPLAYABLY	19
(L2 AND DISPLAY$4 WITH (INFORMATION DATA HIERARCH$8 STRUCTUR$4)).USPT,PGPB,JPAB,EPAB,DWPI,TDBD.	38

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Freeform Search

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Term: L1 and thumb with nail

Display: 20 **Documents in Display Format:** - **Starting with Number** 1

Generate: ○ **Hit List** ◉ **Hit Count** ○ **Side by Side** ○ **Image**

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Set Name side by side	Query	Hit Count	Set Name result set
DB=PGPB,USPT,USOC,EPAB,JPAB,DWPI,TDBD; PLUR=YES; OP=OR			
L2	L1 and thumb with nail	21	L2
L1	edit$3 with (motion mov$4 still) with (graphic$4 picture image)	4482	L1

END OF SEARCH HISTORY

L3: Entry 25 of 38 File: USPT Jul 16, 1996

DOCUMENT-IDENTIFIER: US 5537528 A
TITLE: System and method for inputting scene information

Abstract Text (1):
A scene information editor 12 extracts, for a plurality of scenes, still image data on the representative frames of scenes from a representative frame file, and arranges the still images along with a time axis and in chronological order along a time axis for display on the screen of a display. For the time period corresponding to the part of the time axis specified by a user, the editor extracts motion image data from an LD and displays the motion image data on a TV monitor. The scene information editor also extracts the information given to those scenes from a scene information file 21 and graphically displays the information on the screen of the display 14 at the same time. When the user inputs an edit command, the scene information editor executes it for the edit scene information file 21.

Brief Summary Text (4):
Terms used in the specification are defined before the related art is described. It can be considered that a motion image consists of sequences of still frames. In the specification, any frame sequence constituting a portion of the whole motion image is called a scene. Scene information is distinguished from the frame image itself of a scene, and denotes information provided by a user or application program on an individual scene. In particular, it includes the position of a scene in the motion image (i.e., the starting and ending frame numbers and the time code), the semantic contents of a scene (i.e., the keywords, attributes, and representative frame), the relationship between scenes (i.e., the identifier of parent or child), and information on scene changes (i.e., the position of a change point in the motion image, the change type, and the probability).

Brief Summary Text (6):
Generally, in a motion image, a plurality of continuous scenes, when assembled, have a meaning as a single scene on a higher level, and thus motion images have a structural characteristic that scenes constitute a hierarchy. In addition, they have the temporal characteristic that an item such as a character, object, or background that can be a retrieval key of a scene appears in consecutive frames. In Patent Application No. 4-21443, submitted previously by the present applicant (May 11, 1994, Ser. No. 240,803 to T. Kaneko et al., abandoned Jun. 30, 1994, which was a continuation of filed Oct. 13, 1992, Ser. No. 959,820 to Kaneko et al., abandoned May 11, 1994), a motion image management system is disclosed in which, on the basis of such motion image characteristics, the original motion image is split into scenes of a shorter duration, and information on the hierarchy of scenes and descriptions of the semantic contents of scenes, or still images of representative frames of scenes, are prestored in a storage medium as index information, thereby allowing random retrieval of scenes.

Brief Summary Text (7):
FIG. 1 shows the concept of motion image management in the above-mentioned related art. Motion image 2, consisting of many (for instance, 30 per second) frames f1 to fn, is partitioned into a plurality of scenes 4 that are shorter in duration than the original motion image 2, as shown in FIG. 1 (a), according to physical changes in the frames, such as cuts, changes of camera angle, or changes in the semantic contents. The partitioning of the individual scenes 4 is relative and arbitrary. For instance, a certain scene can be split into a collection of scenes of shorter duration, and conversely, a plurality of consecutive scenes can be merged and viewed as a single scene on a higher level. To describe the logical structure of scenes

based on such an inclusion relationship, a hierarchical tree 1 is created as shown in FIG. 1 (b). The entire motion image 2 corresponds to the root node (R) 5 of the hierarchical tree 1, and the split and merged scenes 4 correspond to the intermediate node 6 and leaf node 7. The arcs 3 indicating the lower and upper adjacent relationships of nodes represent the parent-child relationship of nodes. For each scene corresponding to one node of the hierarchical tree 1, one or more frames (rf) representative of that scene or representative frames 8 are defined, and their still image data (representative frame image data) are generated. In each node of the hierarchical tree, attribute data (At) 9 such as a title or description acting as a retrieval key for a scene are stored along with a reference pointer to the representative frame (rf).

Brief Summary Text (8):
As shown in FIG. 1 (a), to create this hierarchical tree, the system first automatically detects change points in frames f1 to fn of the original motion image 2 and splits the motion image 2 into minimum unit scenes (cut scenes) such as A11 and A12 in order to generate a one-depth tree structure. A user then appropriately merges adjacent cut scenes to form scenes whose contents are related, For instance, A1 may be created from A11 and A12, thereby creating a multi-depth tree structure in a bottom-up fashion. Alternatively, as shown in FIG. 2, the stored original motion image 2 may be split according to the user's decision into arbitrary scenes such as A, B and C, and each scene may then be further repeatedly split into arbitrary scenes of shorter durations (for instance, A may be split into A1, A2, and A3), thereby creating a tree structure in a top-down fashion. In every case, the multi-depth tree structure 1 is created by editing (splitting and merging repeatedly) scenes according to their semantic contents.

Brief Summary Text (9):
Scene retrieval is performed by matching of the attribute data 9 of nodes (5, 6, 7) in the hierarchical tree 1 and node navigation along the arcs 3, using scene information--in this case, the starting and ending frame numbers of each scene, the hierarchy, the attributes, and the representative frame image data and reference pointers thereto. That is, a retrieval condition is specified, which may be a scene attribute (At) or a condition for tracing the hierarchical tree, such as searching for a scene corresponding to the parent, child, or sibling node of the specified node in the hierarchical tree 1. The still images of representative frame 8 and attribute data 9 are displayed as a result of retrieval, and motion image data are accessed and played back for the scene 4 selected by the user from these still images.

Brief Summary Text (10):
FIG. 3 shows the structure of the scene information file disclosed in the above-identified prior application. FIG. 3 (a) shows the structure of a first file for storing the attribute data of scenes, in which one record is assigned to each scene 4 acting as a node of the hierarchical tree, and its identifier 80, its starting frame number 81, and the ending frame number 82 are stored. Further, the values 83 of attributes (At11, At12 . . .) describing the contents of the scene, the frame number 84 of its representative frame, and the reference pointer 85 of its representative frame of the still image file 86 are also stored in the same record. As identifier 80 of a scene, for instance, a value is assigned that uniquely identifies the scene, for example, on the basis of the pair of starting frame number 81 and ending frame number 82. To specify the hierarchical relationship of scenes, a record in which the identifier 87 of a parent scene and the identifier 88 of a child scene are paired is stored in a second file, as shown in FIG. 3 (b).

Brief Summary Text (13):
The first problem is related to a procedure for detecting scene change points and identifying the starting and ending frame numbers of scenes. One example of an approach for automatically detecting physical scene changes is a technique described in Ioka, M., "A Method of Detecting Scene Changes in Moving Pictures," IBM TDB Vol. 34, No. 10A, pp. 284-286, March 1992. Generally, methods for detecting scene changes include comparison of the degree of change in the signal level between continuous frames, or the change in pixel value, with a threshold value. Because of this, the accuracy of such methods depends on the value to which the threshold is preset. If the threshold is set too low, the rate of detection failure (failure to detect a

scene change point) decreases, but the rate of erroneous detection (deeming a point other than a scene change point to be a scene change point) increases; if the threshold is set too high, the result is the opposite. Usually, it is difficult to set the threshold so that there are no detection failure or erroneous detections. Accordingly, scene change points must be verified and corrected by the user while he or she is actually viewing the motion image. Nevertheless, no user interface for efficiently verifying and correcting scene change points has been described up to the present. Because of this, it is cumbersome for the user to instruct the system to play back or stop the motion image, for example, and mistakes are easily made.

Brief Summary Text (14):
The second problem is related to the procedure for describing a scene's contents. Although a text editor or the like is normally used to create a file describing the scene contents, no efficient data input procedure has yet been proposed. Because of this, users sometimes create unnecessary work files and work areas to write essentially the same scene information into different files. In addition, updating one file requires a cumbersome procedure such as a check by the user of the updated file's consistency with correlated files. Furthermore, since correlated information cannot be referred to for scene description, redundant operations such as repeated playback of the same scene and repeated input of the same frame number are required.

Brief Summary Text (15):
The third problem is related to the efficiency of the input operation in general. In the past, the user had to directly input character and numeric data such as frame numbers from an input device such as a keyboard, which was cumbersome. In addition, it was difficult to effectively feed back input scene information to find and correct input errors immediately.

Brief Summary Text (16):
In Ueda, H. et al., "A Proposal of an Interactive Video Image Editing Method Using Recognition Technology," Proceedings of the Institute of Electronics and Communication Information Engineers, D-II, Vol. J75-D-II, No. 2, pp. 216-225, Feb. 1992, a technique is disclosed for automatically splitting an original motion image into scenes, and displaying the image of the leading frame of each scene on a display device in order to browse scenes that are to be subjected to editing (authoring). A software product having the brand name of VideoShop announced by DiVA Corporation and introduced in MACLIFE No. 45, May 1992, pp. 242-245 also provides a function for selecting scenes and arranging them in a desired sequence. On its editing screen, a new sequence of scenes into which the original sequence of scenes has been rearranged is displayed along with a time axis. However, these techniques are intended to enable the user to select and rearrange scenes in order to create a motion image that is different from the original one; they are not directed to making the scene information input efficient.

Brief Summary Text (24):
A scene information editor extracts, for a plurality of scenes, still image data on the representative frames of scenes from a representative frame file, and arranges the still images along with a time axis and in chronological order along a time axis for display on the screen of a display. For the time period corresponding to the part of the time axis specified by a user, the editor extracts motion image data from an LD and displays the motion image data on a TV monitor. The scene information editor also extracts the information given to those scenes from a scene information file and graphically displays the information on the screen of the display at the same time. When the user inputs an edit command, the scene information editor executes it for the edit scene information file.

Drawing Description Text (13):
FIG. 12 is a diagram illustrating the basic construction of the display panel of the scene information editor;

Drawing Description Text (14):
FIG. 13 is a diagram showing an example of a representative frame display area in the scene information editor display panel;

Drawing Description Text (15):
FIG. 14 is a diagram showing an example of the time bar display area in the scene information editor display panel;

Drawing Description Text (18):
FIG. 17 is a diagram showing a panel display example in the representative frame change mode of the scene editor;

Drawing Description Text (19):
FIG. 18 is a diagram showing a representative frame change and its propagation;

Drawing Description Text (20):
FIG. 19 is a diagram showing a panel display example of the scene hierarchy editor;

Detailed Description Text (2):
FIG. 4 shows the flow of a process from splitting a motion image consisting of chronologically ordered frame sequences into scenes that are partial frame sequences of the whole motion image, through inputting scene information after verification and correction of the splitted scenes, up to registering the input information in a motion image database. The invention included in this application includes (a) a step for detecting scene change points, (b) a step for generating scene information on the basis of the detected scene change points and storing it in a scene information file, (c) a step for graphically displaying scene information on a display, (d) a step for executing the edit command specified by the user operating the input means to edit the scene information file, and (e) a step for registering the scene information contained in the scene information file in the database means.

Detailed Description Text (4):
The above step (b) includes a step for creating a representative frame file in which still image data on representative frames are stored for scenes defined by logically splitting the motion image according to the scene change information; a step for creating a scene information file that contains the starting and ending frame numbers of scenes; the type and probability of each scene change; the representative frame numbers; and the addresses at which the data on representative frames are stored.

Detailed Description Text (5):
In the above step (c), one or more charts graphically presenting scene information are displayed. The possible types of charts are the scene chart 30, scene hierarchy chart 31, and scene keyword chart 32, examples of which are shown in FIGS. 5 to 7. The type of chart to be displayed is selected by the user.

Detailed Description Text (6):
The scene chart 30 exemplified in FIG. 5 displays the shrunken images 33 of representative frames selected for individual scenes, the shrunken images 33 being arranged in time sequence along the time bar 34, which is an object representing a time axis. This chart has a region 35 that displays the type and probability of a scene change, at a scene change point, or the leading frame of a scene.

Detailed Description Text (7):
The scene hierarchy chart 31 exemplified in FIG. 6 is displayed simultaneously with the scene chart 30, and represents the hierarchy depth of scenes according to their distance from the time bar 34. Specifically, boxes 36 are arranged in a direction perpendicular to the time bar 34, and the order of the boxes is made to correspond to the hierarchy depth. An object representing information on the hierarchy of a scene is displayed in an area 37 whose position is defined by the interval corresponding to the particular scene on the time bar 34 and the box 36.

Detailed Description Text (8):
In the scene keyword chart 32 exemplified in FIG. 7, the boxes 38 are arranged in a direction perpendicular to the time bar 34 of the scene chart 30, and if a keyword is assigned to a scene, an object representing its information is displayed in the area 39, whose position is defined by the interval corresponding to the particular scene and the box 38 of the particular keyword. Preferably, the keyword is

associated with a still image such as an icon symbolizing its contents, and is displayed by using the still image. Alternatively, by associating a still image with the identifier of a keyword, the still image itself is treated in the same manner as the keyword. In this specification, the keyword is a concept that includes both the identifier and the still image.

Detailed Description Text (9):
In the above step (d), an edit command is accepted. This edit command is specified by the user through direct manipulation such as pointing to, moving, and copying an object displayed on the screen in the above step (c). This step includes a sub-step of responding to the specification of the shrunken image 33 of the representative frame by the user in each of the above charts to play back the scene corresponding to the particular representative frame, and if an interval on the time bar 34 is specified, playing back the motion image corresponding to the specified interval.

Detailed Description Text (10):
If the scene chart is selected in the above step (c), a command for adding or deleting a scene change point is accepted in one mode, a command for changing a representative frame is accepted in a second mode, and a command for updating scene attribute information is accepted in a third mode. In this way the scene information file is edited, and sometimes the representative frame is also edited. If the scene hierarchy chart is selected, commands for splitting and merging scenes and a command for changing the hierarchy depth are accepted, and as a result the scene information file is edited. Further, if the scene keyword chart is selected, commands for setting and canceling a keyword allocation to a scene are accepted and used to edit the scene information file.

Detailed Description Text (11):
Alternatively, if both the scene hierarchy chart and the scene keyword chart are selected at the same time in the above step (c), both charts are simultaneously displayed. In the first mode, in this case, in response to manipulation of an object on one chart, the scene information corresponding to that chart is updated. In the second mode, in response to manipulation of an object on one chart, the scene information corresponding to the other chart is updated. In the third mode, in response to manipulation of an object on one chart, the sets of scene information corresponding to all the charts are simultaneously updated.

Detailed Description Text (12):
When the above step (d) is repeated and the end of the input operation is specified, in the above step (e), a command for registering the scene information file and, when appropriate, a command for registering the file of representative frame images are generated and sent to the database means.

Detailed Description Text (13):
FIG. 8 shows an example of the configuration of a scene information input system in which the present invention is incorporated. The system consists of a motion image storage and display unit 10, a scene change detection unit 11, a scene information editor 12, a registration processing unit 13, a display 14, and an input device 15.

Detailed Description Text (14):
The motion image storage and display unit 10 includes a laser disk (LD) 16 on which a motion image is stored as an analogue image, a laser disk player (LD player) 17, a TV monitor 18, and a video signal converter 19. The LD player 17 has an interface that responds to an external control signal from the scene information editor 12 or the like to send the analogue image in the LD 16 to the TV monitor 18 or video signal converter 19. The LD player 17 also includes an interface that responds to an external control signal by returning data such as the number of the frame that is currently being played back. The analogue image is input from the LD player 17 to the video signal converter 19, which converts analogue signals into digital ones to output a digital image.

Detailed Description Text (15):
The scene change detection unit 11 outputs a control signal to the LD player 17 to sequentially capture the image data of consecutive frames, detect scene change points, and calculate scene change probabilities. As a result of detection, a scene

information file 20 is created in which are recorded the number of each frame in which a scene change has occurred, the type and probability of the change, and the number of the frame representative of the scene (for instance, the leading frame). FIG. 9 shows an example of a scene change information file 20, in which a change frame number 901, a representative frame number 902, a change probability 903, and a change type 904 are stored as one record. Of the values in the field 904, "1" represents "normal" and "2" represents "dissolve." What they mean is described later, along with the details of the scene change detection processing.

Detailed Description Text (16):
The scene information editor 12 consists of a scene editor module, a scene hierarchy editor module, a scene keyword editor module, and a cross editor module. Every module displays scene information stored in a scene information file 21 and representative frame file 22 on the display 14, and responds to a user's specification through the input means 15 to update the scene information file 21 and representative frame file 22. In particular, the scene editor inputs the scene change information file 20 to create a scene information file 21 and representative frame file 22.

Detailed Description Text (17):
FIG. 10 shows the structures of the scene information file 21 and representative frame file 22. The scene information file 21 consists of files (a), (b), and (c), but files (a) and (b) are same as those shown in FIG. 3. Accordingly, the same elements are referred to by the same numerals, and description of files (a) and (b) is omitted. In this embodiment, because of the construction of a motion image database in which scene retrieval is performed by means of keywords such as the names of characters or the types of background, an identifier 89, starting frame number 91, ending frame number 92 and keyword 90 assigned thereto are stored as one record in the third file (c) for each scene. Examples of such motion image databases are disclosed in Oomoto, E. and Tanaka, K., "A Video Object Model and Its Application to a Video Database System," IEICE Tech. Rep. Vol. 89, No. 466, 1990, pp. 33-40 and patent application No. 4-65620 (U.S. Pat. No. 5,428,774 to Hashihara et al.). The modules of the scene information editor 12 identify a record by means of the scene identifiers 80, 87, 88, and 89 of files (a), (b), and (c), and refer to and update scene information. Although it is not shown, file (a) may include scene change type and probability fields. The representative frame file 22 is a collection of still image files 86 created for individual scenes.

Detailed Description Text (18):
In response to instructions issued by the user through the input device 15, the scene information editor 12 issues control signals to specify pauses in the playback of an image and frame number acquisition. In response thereto, the LD player 17 stops the playback of the image and displays the current still frame on the TV monitor 18 while supplying the number of the still frame to the scene information editor 12. The input device 15 is typically a character and numeric value input device such as a keyboard, mouse, or touch panel.

Detailed Description Text (19):
The registration processing unit 13 generates a command for storing the scene information file 21 and, when appropriate, a command for storing the representative frame file 22 in the database 24, and sends them to the database management unit 23.

Detailed Description Text (22):
The scene change information file 20, scene information file 21, representative frame file 22, keyword information file 25, and keyword image file 26 are usually stored in the main memory or an external storage device of a computer. As shown in FIG. 10, these files may be a collection of sub-files.

Detailed Description Text (24):
The scene change detection unit 11 is now described in detail. This unit calculates, by a method depending on the type of change, the degree of change for each frame in order to detect scene change points of different types. The degree of change is the change in the pixel value from the preceding frame.

Detailed Description Text (25):
The most representative examples of scene change types are "normal" and "dissolve," and a method for detecting them is described below. Here, "normal" means that the camera angle completely changes from one frame to the next, or that a scene changes on account of the passage of time between events in a motion image. "Dissolve" is a scene change caused by simultaneous occurrence of fade-in and fade-out. A normal scene change ends immediately, whereas a dissolving scene change requires several dozen frames.

Detailed Description Text (26):
The details of an example of a process for detecting the "normal" type of scene change are disclosed in the references given in the description of the related art. In brief, for each frame, the frame difference mean FDM(j), which is the absolute differences in pixel value between the current frame (j) and the preceding frame (j-1) is, first calculated, and then the difference DFDM(j) between the mean value FDM(j-1), which is the difference between the frame before last (j-2) and the preceding frame (j-1), and the previously calculated mean value FDM(j) of the difference is calculated. Subsequently, a check is made to determine whether a zero cross has occurred between the calculated DFDM(j) and the last DFDM(j-1). If a zero cross has occurred, the absolute value of the difference between DFDM(j) and DFDM(j-1) is compared with a preset threshold. If the difference is larger than the threshold, frame number j is recorded in the scene change information file 20 as the change frame number 901 (FIG. 9), and it is deemed that a normal type of scene change has occurred. A value representing "normal" is set in the field 904. As the representative frame number 902, the value resulting from the addition of a predetermined value to the change frame number 901 is recorded in the scene change information file 20.

Detailed Description Text (28):
1) The image of one frame is captured from the video signal converter 19.

Detailed Description Text (29):
2) If there is no frame any more, the processing is terminated.

Detailed Description Text (32):
5) The difference between the current frame and the preceding frame is calculated for each sub-sampled pixel.

Detailed Description Text (34):
6) The frame difference calculated at this time is divided by the previously calculated frame difference at each sub-sampled pixel. Further, the ratio of all the sub-sampled pixels whose calculated ratio show positive values is calculated.

Detailed Description Text (36):
8) Whether the current frame is located at local maximum or minimum in the series of the filtered ratio is checked. If it is local maximum, the ratio is recorded as Lmax, and if local minimum, as Lmin. If the current frame is neither maximum nor minimum, the process returns to (1).

Detailed Description Text (38):
10) If the current frame is local maximum, the process advances to (11). If minimum, the process skips to (12).

Detailed Description Text (39):
11) Since the current frame may be the starting point of dissolve, a value representing ON is set for a variable search switch, and the number of the current frame (assumed to be ST) is recorded.

Detailed Description Text (40):
12) If the variable search switch is ON, the current frame may be the ending point of "dissolve," and thus the process moves to (13). If the switch is not ON, the process returns to (1).

Detailed Description Text (41):
13) If the difference between the number of the current frame (assumed to be CT) and

the number (ST) of the frame at which the search was started is within the search range, dissolve has happened. If the difference is outside the search range, dissolve has not happened. The search range is provided as a parameter at the starting point of the whole process for detecting scene changes. Usually, it is a value corresponding to a time of about three seconds.

Detailed Description Text (43):
15) Since the type of change is "dissolve," a frame representing minimum is recorded as the ending point of the dissolve and the process returns to (1).

Detailed Description Text (44):
The frame number ST is recorded in the change information file 20 as the change frame number 901. A value representing "dissolve" is set in the field 904. The value resulting from adding a predetermined value to the change frame number 901 is recorded in the scene change information file 20 as the representative frame number 902. The value obtained by normalizing the difference of the maximum and minimum calculated in step (9) for the starting frame of the dissolve is used as the scene change degree C.

Detailed Description Text (46):
The scene information editor 12 is the main portion of the present invention. The method of displaying scene information is first described below, and then the input operation procedure and the operations of all the editors are described.

Detailed Description Text (47):
As shown in FIG. 12, the scene information editor 12 places on the screen of the display 14 a frame information display area 40, a processing mode display area 41, a video control button 42, a representative frame display area 43, a time bar display area 44, an edit area 45, and edit command area 46, and a display panel/manipulation mode switch area 47. The scene chart 30 shown in FIGS. 5 to 7 consists of the representative frame display area 43 and the time bar display area 44. In addition, the scene hierarchy chart 31 and scene keyword chart 32 are displayed in the edit area 45.

Detailed Description Text (48):
The representative frame display area 43 is an area in which, for a plurality of scenes, as exemplified in FIG. 13, the shrunken images 33 of the representative frames are shown, and the scene change type 51 and probability 52 are displayed for each scene change point. Finally, the representative frame display page forward/backward button 53 is an area in which the scrolling of representative frames is specified.

Detailed Description Text (49):
Since one scene has one representative frame if scene information is edited for cut scenes, the shrunken images 33 are placed in such a way that there is one for each scene. FIG. 13 shows an example of such placement. However, at higher levels in a hierarchy tree, one scene may have a plurality of representative frames. In this case, all of the shrunken images 33 of the particular scene may be shown in a time sequence. Alternatively, if the earliest representative frame, for instance, is automatically selected, the external appearance of the representative frame display area 43 is as shown in FIG. 13, even for higher level scenes.

Detailed Description Text (50):
The time bar display area 44 is an area in which, as shown in FIG. 14, the cursors 55, 56, and 57 are displayed on the time bar 34 representing a time axis. The work frame cursor 55 designates a frame, and the frame interval cursor 56 designates the starting and ending positions of a frame interval. The cursors 55 and 56 allow the user to set a frame or frame interval as an object to be manipulated in the step (d) described in "Means for solving the problems." These cursors are moved interactively by the user operating input means 15 by, for instance, dragging a mouse cursor (not shown). By clicking the time bar 34 with the mouse cursor, the state in which the cursors 55 and 56 are displayed and the state in which they are not displayed can be switched. The display frame cursor 57 indicates the current frame position of the motion image being displayed on the TV monitor 18.

Detailed Description Text (51):
In FIG. 14, an interval of an equal length (LO) is assigned to every scene. The number of frames corresponding to the length LO depends on the scene. The positions of the cursors 55, 56, and 57 and the numbers of the frames designated by them are correlated as follows. That is, taking scene I in FIG. 14 as an example, the frame number F designated by the cursor 55 is calculated by the following expression, if it is supposed that the distance between the starting point of the scene and the point designated by the cursor 55 on the time bar 34 is LC and the starting and ending frame numbers of scene I are Si and Ei, respectively.

Detailed Description Text (52):
The starting and ending frame numbers of the frame interval designated by cursor 56 are calculated in a similar manner. In addition, the position at which cursor 57 is displayed is obtained by converting the number (F) of a frame that is being played back into a position (LC) on the time bar 34.

Detailed Description Text (53):
In all the editors and modes described below, in response to specification of the shrunken image 33 of a representative frame by the user operating the input device 15, or setting of a frame interval in the time bar display 44 with subsequent operation of the video control button 42, the motion image of a specified time period is played back. For instance, in FIG. 14, if the shrunken image 33 of scene I is clicked, the part of the motion image from frame Si to frame Ei is displayed on the TV monitor 18. In addition, when specified by the frame interval cursor 56, the part of the motion image from frame SS to frame EE is displayed on the TV monitor 18. Alternatively, a window may be provided in part of the scene information display panel for displaying the motion image, or a scene may be played back in area occupied by the corresponding shrunken image 33.

Detailed Description Text (54):
In FIG. 12, the frame information display area 40 shows information on a frame to be manipulated, such as the position of the said frame in the whole original motion image. The display panel/manipulation mode switch area 47 has areas for specifying display panel switching and selection of the processing mode in each panel (including a mode switch button 58 and an editor switch button 59 shown in FIG. 15), and an area for specifying the start-up of the registration processing unit 23 (the registration button 68 in FIG. 15). The edit mode selected there is displayed in the processing mode display area 41, while the edit commands that can be selected in the current processing mode are displayed as a menu in the edit command area 46. The video control button 42 is an area for instructing the scene information editor 12 to send a control signal for image playback to the motion image storage and display unit 10. In edit area 45, the scene information editor 12 displays scene information in the form of a scene chart, scene hierarchy chart, or scene keyword chart. The user specifies an edit operation by specifying, moving, and copying of the object displayed in the chart, setting the cursor in the time bar, and selecting of an edit command, and the scene information editor 12 executes the specified command.

Detailed Description Text (57):
The scene editor allows the user to verify a scene change point and correct any error made by the scene change point detection unit 11 while viewing the representative frame of a scene or the motion image corresponding to the scene, to edit the attribute information of the scene and to change the representative frame.

Detailed Description Text (58):
First, the scene editor reads the scene change information file 20, sends the frame number of the representative frame to the motion image storage and display unit 10, captures the image data of that frame from the motion image storage and display unit 10, and sub-samples pixels, thereby creating and adding the still image file 86 to the representative frame file 22. Then, it extracts the frame number in which a scene change has occurred from the scene change information file 20, and calculates the starting and ending frame numbers of the scene from the frame number to create a scene information file 21 as shown in FIG. 10.

Detailed Description Text (59):
Then, the scene editor accesses the scene information file 21, as exemplified in

FIGS. 15 to 17, and according to the data stored therein, presents scene information by using the scene chart 30. According to the user's specification, the scene editor displays either representative frames for all the scenes partitioned by the scene change detection unit 11 in chronological order, or only the scenes including scene change points whose probabilities are included in a previously specified range, including the preceding scene when appropriate. In the latter case, all the scenes meeting the condition are displayed either in chronological order or in the descending order of the possibility Q of detection error, according to the user's specification. The possibility Q of detection error is given, for instance, by .vertline.0.5-P.vertline.. P is the probability of a scene change point. Incidentally, a scene change type may be specified in lieu of probability as the condition for selecting a scene, or both may be specified at the same time.

Detailed Description Text (60):
The shrunken image 33 to be displayed is created by shrinking the image of the representative frame image 86. Because of the cost of using the storage device, and the quality and display speed of the image playback, the image size of one frame to be stored in the representative frame file 22 should preferably be between the original frame size and the size of the shrunken image 33.

Detailed Description Text (61):
It has already been stated that a representative frame page forward/backward button 53 is provided to cause display of a desired representative frame. In addition, in the panel shown in FIG. 15, when the endmost, lower-right-corner button 53 is clicked, the representative frames for one panel, in this example, for 48 scenes, are scrolled. Further, a command to allow the user to jump to any scene whose identifier is typed in the edit command area 46.

Detailed Description Text (62):
The scene editor operates in modes for verifying and correcting scene change points, for editing the scene attributes, and for changing representative frames. If the work frame cursor 55 is displayed, the panels exemplified in FIGS. 15 to 17 are displayed in response to the user's selection of the mode switch button 58 to change the mode by using a mouse cursor (not shown). If the work frame cursor 55 is not displayed, a target scene is specified by the user when the mode changes from scene verification and correction (FIG. 15) to scene attribute edit (FIG. 16) or representative frame change (FIG. 17). The specification is provided by clicking one of the shrunken images 33 in the scene change point verification and correction mode. If the specification provided by the cursor 55 conflicts with that provided by the mouse cursor, the predetermined specification of higher priority is used.

Detailed Description Text (65):
To add a scene change point, the user uses the input device 15 to instruct that the motion image should be frozen at a frame in which the scene has changed, and subsequently selects the command for adding a scene change point, shown in the edit command area 46. In response to this, the scene editor splits the scene, with specified frame as the scene change point. Now, let us suppose that scene T is split into scenes T1 and T2 by an operation for adding a scene change point, and that scene T1 is earlier in time. If the representative frame of scene T is not included in scene T1, for instance, the leading frame is treated as the default representative frame, and the image file 86 for that frame is created. The still image file 86 of scene T directly becomes the image file of scene T2. Conversely, if the representative frame of scene T is not included in scene T2, the leading frame, or the frame frozen at the user's instruction, is treated as the default representative frame, and a still image file 86 for that frame is created. The still image file 86 of scene T directly becomes the image file of scene T1. In either case, the records of scenes T1 and T2 are inserted into parts (a) and (c) of the scene information file 21 shown in FIG. 10, the record of the original scene T is deleted, and the scene chart 30 is updated on the basis of part (a) of the updated scene information file 21.

Detailed Description Text (66):
To cancel a scene change point, the user specifies the extent of scenes merged into one scene by clicking a plurality of continuous scenes or by specifying the initial and final scenes with the frame interval cursor 56. Subsequently the user specifies

the representative frame of the new scene. This is done by clicking the shrunken image 33 of the representative frame of any of the scenes to be merged, or by freezing the video image displayed on the monitor 18 at a desired frame, and subsequently selecting the command for canceling scene change points, shown in the edit command area 46. In response to these specifications, the scene editor merges the specified scenes into a single scene, and the specified frame is defined as its representative frame. If no representative frame is specified, the earliest of the representative frames included in the interval for which merging is performed is selected. In this case, the record of the new scene is inserted into part (a) of the scene information file 21, and the records of the old, merged scenes are deleted, while the scene chart 30 is updated according to the contents of part (a) of the updated scene information file 21.

Detailed Description Text (67):
Thus, in the scene change point verification and correction mode, the precision with which scene change points are detected can be substantially increased by setting the range of the degree of change within which detection failure and erroneous detection occur, and by having the user reobserve the frames preceding and following a scene change point that is included in the range. Furthermore, limiting the range makes the amount of labor required much less than that needed to observe all the scene change points. In addition, controlling the motion image display speed according to the probability of scene change reduces the number of complicated display control operations by the user, and thus makes the verification and correction work more efficient.

Detailed Description Text (68):
The scene attribute edit mode is now described. In this mode, the scene attribute edit panel exemplified in FIG. 16 is displayed. The edit area 45 of this panel consists of a scene hierarchy display area 60 and a scene attribute input area 61. By using the cursor 55 to designate a representative frame in the scene chart 30, or by designating a node of the scene hierarchy tree displayed in the scene hierarchy display area 60, the user specifies a scene, whose attributes he or she wishes to describe, subsequently keys in scene attributes such as a title and a description of the contents, in the scene attribute input area 61, and selects an attribute recording command in the edit command area 46. The scene editor executes this command to store attribute data on the designated scene in the attribute field of the record maintained in part (c) of the scene information file 21.

Detailed Description Text (69):
Finally, the representative frame change mode is described. In this mode, the attribute and representative frame change panel exemplified in FIG. 17 is displayed. The edit area 45 of this panel includes a candidate image display area 62, capture button 63, and registration button 64. In this mode, the user specifies that the representative frame of a scene should be changed to another frame of the scene. The specification of operation includes issuance of instructions for freezing the motion image on the monitor 18, and subsequent clicking of the frame capture button 63. In response to the specification, the scene editor inputs a video image from the motion image storage and display unit 10, creates a still image file of the specified frame, and displays its image in the candidate image display area 62. In response to the subsequent clicking of the registration button 64, the scene editor adds the still image file 86 of a new representative frame to the representative frame file 22, updates part (a) of the scene information file 21 in order to update the representative frame number 84 of the particular scene, and displays the still image of the new representative frame at the corresponding position in the representative frame display area 30.

Detailed Description Text (70):
A change of the representative frame of a scene is propagated to the scene's parent and child scenes in the scene hierarchy. The example in FIG. 18 shows the states before and after a change of the representative frame of a scene that has child scenes. When the representative frame of scene A is changed from f1 to f2 (<f1), the representative frame of child scene A1 of A is also changed to f2, because A1 includes frame f2. Accordingly, the pointer 191 of A1 to the image file points to the same address as the pointer 190 of A. The change of the representative frame of the parent scene is similarly propagated to child scenes as far as leaf node scenes.

Simultaneously, the change of the representative frame of scene A is propagated to its parent scene if the representative frame of a scene that is the parent of A is included in A. The change of the representative frame of the child scene is similarly propagated to parent scenes as far as the root node scene.

Detailed Description Text (72):
If the user presses the editor switch button 59 in the panels shown in FIGS. 15 to 17, the scene editor is initiated, and as exemplified in FIG. 19, the scene chart 30 is displayed in an area in the upper portion of the panels and the hierarchy chart 31 showing scene hierarchy information is displayed in another area, in the lower portion. By default, all the scenes are subjected to display, but the user may previously limit displayed scenes to those are to become leaves or scenes of a specific hierarchy depth. In FIG. 19, only scenes that become leaves are displayed. In the initial state of the hierarchy chart, one depth is shown, with the whole motion image viewed as a parent scene and with each scene split by the scene change detection unit 11 viewed as a child scene. From this initial state hierarchy, the user inputs commands for changes in the scene hierarchy, such as splitting and merging of input scenes to create a complicated hierarchy for the scenes and they are executed. FIG. 20 shows the hierarchical relationship corresponding to FIG. 19 in a manner similar to FIG. 2. The scenes A to L for which the shrunken image 33 of the representative frame is shown in FIG. 19 correspond to scenes S1, S2, S31, S32, S331, S3321, S3322, S333, S334, S3351, S336, and S337, respectively.

Detailed Description Text (73):
A scene hierarchy change command is input directly by the user manipulating an object on the display panel. Specifically, the user performs the following operation. First, he specifies a scene to be manipulated by setting a cursor 55 or 56 on the time bar 34 or by clicking the shrunken image 33. Subsequently, he performs one of the following operations.

Detailed Description Text (76):
c) A split command is selected in the edit command area 46. In this case, the split point is indicated by the work frame cursor 55 on the time bar 34.

Detailed Description Text (81):
The representative frames of child scenes that are newly created when a scene is split are automatically established on the basis of the representative frame of the parent scene. The example shown in FIG. 22 shows the states before and after the establishment of the representative numbers of child scenes A1 and A2 and pointers to the image file, when scene A having frame f1 as a representative frame is split at frame f2 (<f1) to create child scenes A1 and A2. The representative frame of A is f1, which has a reference pointer 220. Since the frame f2 at which splitting is performed has a frame number lower than f1, the representative frame of A1 is the leading frame f3, which is a default, and the representative frame of A2 becomes f1, which is also the representative frame of A. Further, the pointer 221 for A2 to the image file points to the same address as the pointer 222 for A. There is an empty pointer 223 for A1, but, when the image file of frame f3 is created, it is replaced by the address of the file. Conversely, if scenes A1 and A2 are merged into A, whichever of the representative frames of A1 and A2 is selected by the user becomes the representative frame rf of A.

Detailed Description Text (85):
a) A frame interval or scene is specified in the scene chart 30. Subsequently, a box 38 representing a desired keyword is clicked. The editor interprets this as a cancel command for keyword assignment if the specified keyword has already been assigned to the specified scene; otherwise it interprets it as a keyword assign command.

Detailed Description Text (87):
c) Two frame intervals are established in the scene chart 30. Subsequently, in the edit command area 46, a command is selected for cutting the keyword bars 66 out of one interval and pasting them into the other.

Detailed Description Text (92):
The files that the scene keyword editor edits in this mode are the keyword information file 25 and the representative file 26, both shown in FIG. 8. In the

keyword information file 25, the identifier, attribute, and storage address in the still image file are stored in one record for each keyword. The keyword image file 26 is a collection of still image files that are created for each keyword. If the user wants to provide an attribute to a keyword, he keys in the attribute and selects an input command, using the same operation as for the scene attribute edit panel. In addition, when a keyword image is selected from a video image frame, the user inputs the commands for capturing and registering the frame functioning as the keyword by using the same operation as for the representative frame change panel. The editor executes those commands to edit the files 25 and 26.

Detailed Description Text (96):
In the cross-pointing mode, the cross editor updates the hierarchy chart 31 and edits the scene information file 21 in response to direct manipulation of an object in the keyword chart 32, or conversely, it updates the keyword chart 32 and edits the scene information file 21 in response to direct manipulation of an object on the hierarchy chart 31. For instance, the manipulation shown by a downward arrow in FIG. 26 is an instance of the former operation, in which the specification of the hierarchy bar 65X in the hierarchy chart 31 is accepted as the specification of the keyword bar 66X. That is, if the user specifies the hierarchy bar 65X in the hierarchy chart 31 after specifying the boxes 38A and 38B in the keyword chart 32, the cross editor displays the keyword bar 66X in the keyword chart 32 and updates the scene information file 21 (c) accordingly. Alternately, the user may directly drag the bar 65X to draw the bar 66X. Further, the manipulation shown by an upward arrow in FIG. 26 is an instance of the latter operation, in which the specification of the keyword bar 66Y is accepted as a command for splitting a scene at the starting frame SY and ending frame EY, respectively, of the corresponding interval in the hierarchy chart 31.

Detailed Description Text (97):
In the interlocking mode, the cross editor simultaneously updates scene hierarchy information and keyword assignment information in response to manipulation of an object on either chart. For instance, in the editing keyword chart 32, it updates the hierarchy chart 31 so that a scene is split at the starting and ending frames of an interval that was assigned a keyword, interlocking with the manipulation of an object on the keyword chart 32, and thereby updating parts (a), (b), and (c) of the scene information file 21.

Detailed Description Text (98):
Thus, during the inputting of scene information, a user interface is provided for visually displaying scene information in the form of the hierarchy chart and keyword chart along with the still image of the representative frame, so that the user can grasp scene information intuitively and any erroneous input is immediately fed back. In addition, by means of an interface for directly manipulating an object on the displayed chart, the frequency of key-ins and erroneous operations at the time of input is decreased, as a result of which the input operability is increased. In command input operations for verification and correction of scene change points, changes of the scene hierarchy, and inputting a scene keyword, the work can be clearly seen thanks to the interface for cross-referring to scene information. In addition, by using an interface that interprets one command input operation as an edit command to different kinds of scene information files, the user can save time and labor in checking the consistency of data in those files, and the burden on the user of verifying input information is lightened.

Detailed Description Text (100):
In order to perform motion image retrieval by using the still image of a representative frame as in the above-identified prior patent application No. 4-21443, information for accessing a still image file 86 is passed to the unit 23. A command for loading the still image file is also generated by using that information and transferred to the unit 23 for execution. Alternatively, in order to perform motion image retrieval by using keywords as in the above prior patent application No. 4-65620, it is convenient if the motion image database 24 has keyword information and keyword images. In this case, commands for loading the files 25 and 26 are generated in a manner similar to that for loading the scene information file 21 and the representative frame file 22, and sent to the unit 23.

CLAIMS:

1. A computer system for inputting information on scenes that are portions of a motion image, said motion image consisting of a linear sequence of frames and scenes, each said scene being a continuous sequence of said frames, comprising:

(a) means for storing motion image data,

(b) input means,

(c) display means having a display surface,

(d) database means,

(e) means for detecting scene changes in motion image data extracted from said means (a),

(f) means for generating scene information according to the detected scene changes and storing said scene information in a scene information file,

(g) means for causing graphical display of scene information on the display surface of said display means,

(h) means for executing an edit command input by a user operating said input means to edit said scene information file, at least some of said edits serving to apply to said scenes in said information file attributes of semantic scene contents, each said attribute applying to a continuous sequence of one or more said scenes, and

(i) means for generating a command executable by said database means for registering scene information in said scene information file, and sending the generated command to said database means.

2. In a motion image processing system comprising, in combination, means for storing motion image data, input means, display means having a display surface, and database means, a method for providing information on scenes that are portions of a motion image and registering said information in a scene information file, said motion image consisting of a linear sequence of frames and scenes, each said scene being a continuous sequence of said frames, said method comprising the steps of:

(a) extracting motion image data from said means for storing motion image data in order to detect scene changes,

(b) generating scene information according to the detected scene changes and storing said scene information in a scene information file,

(c) displaying objects representing scene information on the display surface of said display means,

(d) interpreting the manipulation of said objects performed by a user operating said input means, in order to update said scene information file, some of said manipulations serving to apply to said scenes in said information file attributes of semantic scene contents, each said attribute applying to a continuous sequence of one or more said scenes, and

(e) registering the scene information contained in said scene information file in the database.

3. A computer system for inputting information on scenes that are portions of a motion image, said motion image consisting of a linear sequence of frames and scenes, each said scene being a continuous sequence of said frames, comprising:

(a) data storage means,

(b) a representative frame file stored in said storage means for storing still image data of representative frames, at least one representative frame being associated

with each scene of said motion image,

(c) a scene information file stored in said storage means for storing the information on said scenes,

(d) input means,

(e) display means having a display surface

(f) means for extracting from said representative frame file still image data of representative frames for a plurality of scenes, and causing display of the still images of the representative frames in a first area of the display surface of said display means, said still images being arranged linearly,

(g) means for extracting from said scene information file scene information related to said plurality of scenes, and causing display of said scene information in a second area of said display surface, and

(h) means for executing an edit command input by a user operating said input means, thereby causing the editing of said scene information file, at least some of said editing serving to apply to said scenes in said scene information file attributes of semantic scene contents, each said attribute applying to a continuous sequence of one or more said scenes,

wherein said scene information is information indicating a hierarchical relationship of said linear sequence of scenes, and said means (g) causes graphical display of said hierarchical relationship of scenes.

4. A computer system for inputting information on scenes that are portions of a motion image, comprising:

(a) data storage means,

(b) a representative frame file stored in said storage means for storing still image data of representative frames, at least one representative frame being associated with each scene of said motion image,

(c) a scene information file stored in said storage means for storing the information on said scenes,

(d) input means,

(e) display means having a display surface,

(f) means for extracting from said representative frame file still image data of representative frames for a plurality of scenes, and causing display of the still images of the representative frames in a first area of the display surface of said display means, said still images being arranged linearly,

(g) means for extracting from said scene information file scene information related to said plurality of scenes, and causing display of said scene information in a second area of said display surface, and

(h) means for executing an edit command input by a user operating said input means, thereby causing the editing of said scene information file,

wherein said scene information is information indicating keywords allocated to scenes by a keyword allocation means, and said means (f) causes display of a time axis area along the sequence of still images of said representative frames in said first area, and said means (g) causes graphical display of the keywords that are allocated to scenes corresponding to segments of said time axis.

5. A computer system as set forth in claim 4 further comprising:

(i) a keyword information file stored in said data storing means for storing

information on keywords allocated to scenes by a keyword allocation means,

(k) means for retrieving information on said keywords from said keyword information file, and causing display of said information in the second area of said display surface, and

(l) means for executing an edit command input by the user operating said input means to edit said scene information file, wherein a mode in which said means (g) and (h) operate and a mode in which said means (k) and (l) operate change in response to specification by the user operating said input means.

WEST

Generate Collection

L3: Entry 24 of 38 File: USPT Sep 21, 1999

DOCUMENT-IDENTIFIER: US 5956453 A
TITLE: Method of editing moving image and apparatus of editing the same

Abstract Text (1):
A method of editing an image with the aid of a computer while watching moving image information displayed on a screen includes a step of selecting still images representing a plurality of video scenes or a plurality of video cuts constituting the moving image information, a step of determining a hierarchical structure among a plurality of scenes and a plurality of cuts represented by still images, a step of designating static images related to an optional hierarchical structure portion in the hierarchical structure, and a step of displaying the hierarchical portion including designated still images on a screen with such an arrangement that shows the hierarchical structure. An apparatus for editing a moving image for editing an image with the aid of a computer while watching moving image information displayed on a screen includes a recording apparatus for recording moving image information, a change point detection segment for comparing adjacent frame images with each other, and recognizing that, when information is changed exceeding a predetermined quantity between adjacent frame images, the adjacent frame images are frame images belonging to different cuts, reduced images obtained from frame images constituting respective cuts and information for identifying the cuts being recorded in the recording apparatus, a control segment for generating information for identifying scene images by putting a plurality of predetermined cuts together as scene images, generating information for identifying a motion picture by collecting a plurality of predetermined scenes as a motion picture, and determining a hierarchical structure among the scenes and cuts represented by said reduced images in accordance with the selection of reduced images representing a plurality of video scenes or a plurality of video cuts constituting moving image information, a designation segment for designating reduced images related to a predetermined hierarchical structure portion in the hierarchical structure, and a display monitor for showing a hierarchical portion including designated reduced images with such an arrangement as to show the hierarchical structure.

Brief Summary Text (3):
In JP-A-4-207877, a moving image management apparatus for editing a moving image in the unit of scene or cut is disclosed. In this apparatus, a hierarchical structure of cuts and scenes is displayed on a screen in a tree structure form.

Brief Summary Text (4):
When edit of a plurality of cuts is proceeded using a tree structure (a hierarchical structure), however, all of edit states become no longer displayed completely due to the limit in point of resolution of a monitor screen. In this case, a user has to confirm the display contents by scrolling them, thus causing such a drawback that the operation becomes complicated and the contents are difficult to be grasped.

Brief Summary Text (6):
According to the present invention, such a drawback that, when, for example a user confirms the whole edit state in case moving images are stored in a tree structure (a hierarchical structure) of a plurality of scenes and cuts, managed and displayed as described above in order to search for required scenes and cuts easily, the user has to confirm while operating a scroll bar of a window displaying the tree structure with a mouse is removed or decreased.

Brief Summary Text (7):
A method of editing a moving image with the aid of a computer while watching moving

image information displayed on a screen includes a step in which a plurality of reduced still images representing a video scene or a video cut constituting moving image information is selected, a step in which a hierarchical structure among still images is determined, a step in which still images related to an predetermined hierarchical structure portion in the hierarchical structure is designated, and a step in which a hierarchical portion including the designated still images is displayed with such a hierarchical arrangement.

Brief Summary Text (8):
A recording medium for storing program codes read and executed by a computer according to the present invention stores a first code section representing a procedure for determining a hierarchical structure among the still images in accordance with the selection of a still image representing a video scene or a video cut constituting moving image information, and a second code section representing a procedure for displaying with such an arrangement that a hierarchical portion including designated still images that expresses the hierarchical structure in accordance with that still images related to a predetermined hierarchical structure portion in the hierarchical structure are designated.

Brief Summary Text (9):
An apparatus for editing a moving image with the aid of a computer while watching moving image information displayed on a screen according to the present invention includes a recording apparatus for recording the moving image information, a change point detection segment for detecting a change point of a moving image comparing adjacent frame images with each other and recognizing that the adjacent frame images are frame images belonging to different cuts when the information changes beyond a predetermined quantity of the information difference between adjacent frame images, a recording segment for recording reduced still images obtained by reducing data quantity of frame images forming respective cuts and information or reduced image display file for indicating reduced still images representing the cuts, a control segment for generating information for identifying a scene by putting a plurality of predetermined cuts together as a scene, generating information for identifying a moving image by putting a plurality of predetermined scenes together as a moving image or a motion picture, and determining a hierarchical structure among image scenes and image cuts represented by reduced still images in accordance with the selection of a reduced still image representing a scene or a video cut constituting moving image information, a designating segment for designating reduced still images related to an predetermined hierarchical structure portion in the hierarchical structure, and a monitor for making graphic expression with such an arrangement that the hierarchical portion including the designated reduced still images show the hierarchical structure.

Drawing Description Text (7):
FIGS. 6A, 6B and 6C are diagrams for explaining examples of hierarchical structure display of moving image information by a combination of representative images;

Drawing Description Text (8):
FIGS. 7A and 7B show a flow chart of processing in case only a part of a hierarchical structure is displayed on a monitor screen in an editing method of an embodiment of the present invention;

Detailed Description Text (3):
In FIG. 8, a frame image array constituting a recorded video source is displayed typically as a time series arrangement. The image data of a video source recorded on a magnetic tape are generally arranged in such a form. In a magnetic disk and an optical disk, the image data are not necessarily recorded in such a time series arrangement physically, but another data arrangement is made. Since it is possible to make access to any recorded image data in almost the same time in a disk-shaped recording medium, such recording medium is advantageous.

Detailed Description Text (4):
A "cut" is defined as a set of frame images picked up from the start to the end of photographing operation one time with a TV camera. A "scene" is composed of a set of a plurality of cuts in which a predetermined object is picked up. It is possible to put a plurality of scenes together under a specific image pickup theme. The video

source can be arranged as such a hierarchical structure of information as a plurality of cuts, scenes putting several cuts together, and a motion picture having an image pickup theme (or a title) putting several scenes together. A specifying number is assigned to the cut and the scene, respectively. The number of the layers in the hierarchical structure may be increased by extending the concept of a scene with using a subset such as a chapter.

Detailed Description Text (5):
FIG. 9 shows an example of a tree-form hierarchical structure of a recorded image source. The image pickup theme is "Tropical Island". The recorded image source includes a Cut 1 in which fishes in the sea around the island are picked up, a Cut 2 in which a coastal landscape is picked up, a Cut 3 in which the reptiles inhabiting a forest are picked up, a Cut 4 in which flowers are picked up, a Cut 5 in which birds are picked up, a Cut 6 in which a market view is picked up and a Cut 7 in which a harbor is picked up. The Cut 1 is composed of a first frame to a 90th frame for instance, and the Cut 2 is composed of a 91st frame to a 150th frame. The images of the Cut 1 and the Cut 2 are put together as a Scene 1 in which the picked up object is an image of sea. The Cuts 3, 4 and 5 are put together as a Scene 2 in which the picked up object is a forest. The Cuts 6 and 7 are put together as a Scene 3 in which the picked up object is a town view.

Detailed Description Text (6):
In an editing apparatus according to an embodiment of the present invention which will be described in detail later, it is possible to display a part or the whole of this hierarchical structure on a monitor screen for editing. It is possible to optionally designate which part of the hierarchical structure is to be displayed. On the screen to display the hierarchical structure, a representative frame image among those frame images that constitute respective cuts and a representative frame image among those frame images that constitute respective scenes are displayed as a reduced still image, respectively. It is possible to display not only a reduced still image, but also character information showing an attribute of a reduced still image on a screen to display a hierarchical structure.

Detailed Description Text (7):
According to the embodiment of the present invention, editing of a moving image can be made easily by changing an original hierarchical structure shown on a screen by a simple operation by an operator. For example, it is possible to change, i.e., to edit the Cut 1, the Cut 3 and the Cut 5 to a hierarchical structure having a lower hierarchy of a new Scene 1 with animals living in the island as the picked up object. When an image in which the hierarchical structure is changed in such a way is reproduced, a motion picture edited in the order of the Cut 1, the Cut 3 and the Cut 5 can be seen. In the editing work using a screen to display a hierarchical structure, replacement or elimination of the cut or addition of another cut and so on is possible easily. Furthermore, the sequence of scenes can also be replaced easily. For example, it is possible to edit so as to constitute a sequence such as the Scene 3, the Scene 1 and the Scene 2. In that case, the sequence of the cuts of the lower hierarchy of a scene is also replaced together.

Detailed Description Text (8):
FIG. 1 shows a monitor screen 200 of an apparatus for editing a moving image according to an embodiment of the present invention. In the figure, a window 201 represents an area for editing. Representative images of cuts 210 to 214 and scenes 220 to 221 constituting moving images of the video source to be edited are displayed on the area for editing 201 in a scale-down size. These scale-down images or reduced images are displayed in a tree-form hierarchical structure.

Detailed Description Text (10):
FIG. 2 is a block diagram of a structural example of an apparatus for editing a moving image. Namely, there are provided a CPU 101 for processing various controls, a monitor 108 for displaying information of a hierarchical structure (a tree structure), showing scenes and cuts used for editing a moving image and indicating an edited state and so on, a memory 102 for storing various control programs of the CPU 101 and so on, a frame buffer 107 for storing images to be displayed on a screen, and a cut change point detection segment 103 for detecting a change point of a series of moving images composed of a plurality of cuts as an input. There is

further provided a magnetic storage device 106 for storing a series of moving images, moving image relational information consisting of a frame number and a reduced image display file name in which change points detected in the cut change point detection segment 103 are described, a reduced moving image for high speed display for watching the whole moving image and the scene and so on which are consisted by these plurality of frame images without stretching processing and also reduced to the size displayed as representative image and hierarchical structure management information consisting of a hierarchical number showing what number of the hierarchy each of the plurality of scenes or cuts is located, a reduced image display file name, a cut number attached serially from a first cut for each cut consisting of a plurality of frames, and identifiers showing whether to display on a monitor 108 displaying a hierarchical structure or not. Furthermore, there are provided a video interface 104 for receiving a video signal from a VTR 105 and converting it into a format for handling a moving image with this apparatus, a mouse or a keyboard 109 as input means, and an image compressing segment 112 for compressing the image information inputted from the VTR 105 via the video interface 104 to produce the compressed image data, and expanding the compressed image data to reproduce the image information.

Detailed Description Text (11):
The above-mentioned CPU 101 is connected to a bus 110. And memory 102, cut change point detection segment 103, video interface 104, magnetic storage device 106, frame buffer 107 and image compressing segment 112 are also connected to a bus 110, and are controlled by the access from the CPU 101. The other storage medium may be used or a remote file through a network (such as a network using LAN, RS-232C interface) may be used in place of the magnetic storage device 106.

Detailed Description Text (14):
When a cut change point is decided and the sectioning of the cuts is determined, data of moving image relational information files corresponding to each cut at sectioned with the cut change point as shown in FIG. 4 are generated and stored in the magnetic storage device 106. In a cut number slot 301 of the moving image relational information file, the cut number of that cut is held, in a cut length slot 302, a value corresponding to the number of frames included in the cut is held, in a reduced image display file name slot 303, an almost peculiar cut title corresponding to the cut is held, and, in a frame number slot 304, the frame number of a frame image, for example at the head of the cut is held. In this case, since the whole moving image or the scene consisting of a plurality of frames is seen at a high speed, reduced images are stored in the magnetic storage device 106 as a moving image reduced to the size displayed at a high speed as a high speed display image and displayed as a representative image. ,

Detailed Description Text (15):
In order to take out a predetermined frame image from coded moving image information, decoding and expansion are required, which requires processing time with the CPU 101. However, when uncoded moving image information which is image information reduced for high-speed display is stored in advance as the present embodiment, it is possible to read out the frame image without processing time required for decoding.

Detailed Description Text (16):
An operator instructs to read out a moving image registered in the magnetic storage device 106 by means of a mouse or a keyboard 109. Then, the CPU 101 reads only the first frame of each cut as the change point of the cut of the corresponding moving image, and displays the cut table window 203 of a screen 200 displayed in a monitor 108 as shown in FIG. 1. Corresponding to this display, the operator decides whether the change point of the cut is correct or not. The operator now indicates delimiter of the cuts and now changes the delimiter of the cut by means of the mouse or the keyboard 109.

Detailed Description Text (21):
When the editing is started and an operator selects a reduced still image 804 of the Cut n and a reduced still image 805 of the Cut j displayed in the raw material area 203 by means of the mouse or the keyboard 109 and clicks a "junction" key 810 selectively when these images are in a selected state, reduced still images 804' and

805' corresponding to the Cut n and the Cut j, respectively, are newly displayed as shown in FIG. 6A in the editing area 201 where reduced still images have not been displayed until starting editing. Furthermore, a reduced still image 806 corresponding to a scene (a Scene k) composed of the Cut n and the Cut j is displayed, a connection made to show a related state of these three reduced still images 804', 805' and 806 is displayed at the same time, and a diagram showing a tree structure thereof can be displayed quickly with simple operationality.

Detailed Description Text (22):
At this time, a hierarchical structure management information file consisting of a picture management information file, a scene management information file and a cut image information file corresponding to newly displayed tree structure display described above such as shown in FIG. 5 is generated. In this case, the number of the hierarchy where the Scene k is positioned such as "1" is held in a hierarchical number slot 321 among the slots of the scene management information file, a scene number corresponding to the Scene k such as "k" is held in a scene number slot 322, and one of the cuts which becomes a member positioned in the lower hierarchy of the Scene k such as a cut number "n" corresponding to the Cut n is held in a cut number 1 slot 324 which becomes a member. Similarly, a cut which becomes a member positioned in the lower hierarchy of the Scene k such as a cut number "j" corresponding to the Cut j is held in a cut number 2 slot 325 which becomes a member. In this case, since the number of cuts positioned in the lower hierarchy of the Scene k is 2, data are not held in a cut number 3 slot 326 which becomes a member, but the slot 326 is empty. Furthermore, coordinates information for determining a display position of the reduced still image 806 corresponding to the Scene k and in a displaying position in accordance with the editing area 201 is held in an icon display coordinates slot 327, and information for identifying whether the reduced still image 806 is to be displayed in the editing area 201 or not such as information "to display" is held in a display identifier slot 328.

Detailed Description Text (23):
Furthermore, cut image information files corresponding to the Cut n and the Cut j are generated as a cut image information file among hierarchical structure management information files. Among the slots of cut image information files corresponding to the Cut n, the number of the hierarchy where the Cut n is positioned such as "2" is held in a hierarchical number slot 331, a cut number corresponding to the Cut n such as "n" is held in a cut number slot 301', and a value corresponding to the number of frames of the Cut n is held in a cut length slot 302'. Furthermore, an almost peculiar file title corresponding to the contents of the Cut n is held in reduced image display file name slot 303', and a frame number of a frame image, for example at the head of the Cut n is held in a frame number slot 304'. Furthermore, coordinates information for determining a display position of a reduced still image 804' corresponding to the Cut n in accordance with the editing area 201 is held in an icon display coordinates slot 332, and information for identifying whether the reduced still image 804' is to be displayed in the editing area 201 or not such as information "to display" is held in a display identifier slot 333.

Detailed Description Text (25):
Furthermore, a motion picture image constituted from a plurality of scenes displayed in the editing area 201 such as a motion picture 1 is generated as an upper hierarchy of those respective scenes, and reduced still image corresponding to the motion picture 1 is connected to reduced still images corresponding to respective scenes and displayed. The state of the tree structure is shown in FIG. 6B. A hierarchical structure management information file such as shown in FIG. 5 described above is generated in accordance with the hierarchical structure display. The number of the hierarchy where the motion picture 1 is positioned such as "1" is held in a hierarchical number slot 311 among the slots in the picture management information file of the hierarchical structure management information file.

Detailed Description Text (27):
Furthermore, a motion picture number corresponding to the motion picture 1 such as "1" is held in a motion picture number slot 312 among the slots in the picture management information file. Furthermore, a scene number corresponding to one of the scenes that become members located in the lower hierarchy of the motion picture 1

such as a scene number "1" corresponding to the Scene 1 is held in a scene number 1 slot 313 which becomes a member. Similarly, a scene number corresponding to a scene which becomes a member located in the lower hierarchy of the motion picture 1 such as a scene number "2" corresponding to the Scene 2 is held in a scene number 2 slot 314 which becomes a member, and a scene number corresponding to a scene which becomes a member located in the lower hierarchy of the motion picture 1 such as a scene number "3" corresponding to the Scene 3 is held in a scene number 3 slot 315 which becomes a member. Furthermore, coordinates information for determining a display position of a reduced still image 601 corresponding to the motion picture 1 in accordance with the editing area 201 are held in an icon display coordinates slot 316, and information for identifying whether the reduced still image 601 is to be displayed in the editing area 201 or not such as information "to display" is held in a display identifier slot 317.

Detailed Description Text (28):
As described above, a plurality of reduced still images corresponding to scenes, cuts and the motion picture in respective hierarchies are displayed in the editing area 201 as shown in FIG. 6B. Since the size of the editing area 201 which can be displayed is restricted, however, it is conceived to display only the cuts in the lower hierarchy of the selected scene, and selective display switching is realized by means of the operation described hereunder in the present invention.

Detailed Description Text (29):
Namely, an operator selects one of the reduced still images corresponding to respective scenes displayed in the editing area 201 with the mouse or the keyboard 109. When a "display" key 811 is clicked selectively in case the reduced still image is in a selection state, reduced still images corresponding to the cuts positioned in the lower hierarchy of the scenes where the reduced still images are selected are displayed as they are, and reduced still images corresponding to the cuts positioned in the lower hierarchy of the scenes other than the scenes where the reduced still images are selected become no longer displayed. A change-over of setting whether the reduced still image is to be displayed or not is performed by rewriting the held information in display identifier slots of respective cut image information files corresponding to the cuts not to display in the above-explained hierarchical structure management information file from a value "to display" to a value "not to display". It is possible to be performed by rewriting the held information for not only cuts but also scenes.

Detailed Description Text (32):
When the "display" key 811 is clicked selectively in case the reduced still image 601 is in a selected state, as to the reduced still image displayed in the editing area 201, the reduced still images corresponding to the motion picture 1, the Scene 1, the Scene 2 and the Scene 3 displayed in FIG. 6B are kept as they are displayed, and similarly, the reduced still images corresponding to the Cut 1, the Cut 2 and the Cut 3 positioned in the lower hierarchy of the Scene 1 are kept as they are displayed. The reduced still images corresponding to the other Cut 4, Cut 5 and Cut 6 that have been displayed in FIG. 6B are not displayed in FIG. 6C.

Detailed Description Text (33):
In this case, scene management information files of the scenes other than the selected scene, i.e., the scenes other than the Scene 1 are referred to sequentially using the hierarchical structure management information file. For example, information held in the cut number 1 slot 323 which becomes a member and in the cut number 2 slot 324 which becomes a member in the scene management information file of the Scene 2, i.e., the cut numbers of the Cut 4 and the Cut 5 are read out respectively. Further, the cut image information file of the cuts in the lower hierarchy of the Scene 2 is referred to on the basis of the cut numbers which have been held in respective slots and read out therefrom, and the values of respective display identifier slots of the cut image information file corresponding to the Cut 4 and the cut image information file corresponding to the Cut 5 are set to "not to display". Similarly, the similar processing to the above is performed with respect to the scene management information file of the Scene 3.

Detailed Description Text (34):
Although the tree hierarchical structure has been described as a three-layer

structure in the above description, it is possible to display only the reduced still images at the selected reduced still image or thereafter among a plurality of reduced still images at a desired level by setting the values of the display identifier slots of the lower hierarchy with similar operation even when the number of layers is more than three layers.

Detailed Description Text (36):
The changing of the display position of the reduced still image is performed by rewriting the held information in the icon display coordinates slots of respective scene management information file or the cut image information file corresponding to the objective scenes or cuts in the above-mentioned hierarchical structure management information file into the value of a predetermined coordinate information.

Detailed Description Text (38):
The operator selects a reduced still image 601 corresponding to Scene 1 displayed in the editing area 201 shown in FIG. 6B with operating the mouse or the keyboard 109. When the "display" key 811 is clicked selectively in a selected state, as to the reduced still image displayed in the editing area 201, the reduced still images corresponding to the motion picture 1, Scene 1, Scene 2 and Scene 3 displayed in the screen of FIG. 6B are kept as they are displayed, and the displayed positions are changed, that is for example the distances between adjacent reduced still images corresponding to the Scene 1, Scene 2 and Scene 3 on the screen are shortened. Further, the reduced still images corresponding to the Cut 1, Cut 2, Cut 3, . . . and Cut i positioned in the lower hierarchy of the Scene 1 are displayed at the changed positions.

Detailed Description Text (39):
In this case, the scene management information files of the scenes whose corresponding reduced still images are changed in the position on the screen and the cut image information files of the cuts whose corresponding reduced still images are changed in the position on the screen are referred to by using the hierarchical structure management file. And then, the values of the icon display coordinates slot in the scene management information file of e.g. the Scene 2 is set to a value which makes the distance between the adjacent reduced still images corresponding to the Scene 1 and Scene 2 shorten. The same process is also taken for the values of the icon display coordinates slot in the scene management information file related to the other scenes or the cut image information file related to the cuts.

Detailed Description Text (40):
A processing flow chart when only a part of hierarchical structure designated by an operator is displayed is shown in FIGS. 7A and 7B.

Detailed Description Text (41):
In a step 701, a reduced still image corresponding to a scene is selected. In a step 702, the "display" key 811 in an icon 240 is clicked. In a step 703, access is made to the picture management information file (FIG. 5-(A)) in accordance with a motion picture in the upper hierarchy of the scene (selected scene) corresponding to the selected reduced still images. In a step 704, "a scene number which becomes a member" corresponding to other than the selected scenes in the file is referred to. In a step 705, it is determined whether the slot of "the scene number which becomes a member" of the picture management information file is empty or not. If the slot is empty, the processing is completed in a step 706. If the slot is not empty, access is made to the scene management information file (FIG. 5-(B)) of the scene in accordance with the data contents of "the scene number which becomes a member" in a step 707. In a step 708, a slot of the first "cut number which becomes a member" of the scene management information file is selected. In a step 709, access is made to the cut image information file (FIG. 5-(C)) of the cut in accordance with the data contents of the slot of "the cut number which becomes a member". In a step 710, the data contents of the slot of the display identifier are set to "not to display". In a step 711, it is determined whether the slot of the second "cut number which becomes a member" in the scene management information file (FIG. 5-(B)) is empty or not. If the slot is not empty, the processing is returned to the step 709. In a step 712, it is determined whether the slot of the second "scene number which becomes a member" of the picture management information file (FIG. 5-(A)) is empty or not. If

the slot is empty, the processing is completed, and if the slot is not empty, the processing is returned to the step 707.

Detailed Description Text (42):
As described above, according to the present invention, it is possible to grasp the edited video contents quickly by arranging so that, when reduced still images corresponding to scenes and cuts constituting a motion picture are displayed in accordance with a hierarchical structure, all of representative images of the whole hierarchical structure are not displayed with scrolling, but only reduced still images corresponding to the scenes or the cuts that belong to the scenes of the selected hierarchy or thereafter are displayed with respect to the scenes and the cuts in a predetermined hierarchy or thereafter.

CLAIMS:

1. A method of editing moving images comprising:

inputting said moving images, said moving images including a plurality of scenes, each scene including a plurality of cuts and each cut including a plurality of frames;

detecting change portions of said moving images and dividing said moving images into said scenes and cuts;

selecting a still image representing each of said scenes and cuts;

storing position information with respect to said change portions of said moving images and said representative still images of said scenes and cuts;

designating said representative still images of said scenes and cuts to edit said moving images;

determining a hierarchical structure, said hierarchical structure including at least a plurality of said representative still images of said scenes and said representative still images of said cuts relating to at least one scene selected from said scenes; and

displaying an entire image of said hierarchical structure on a screen, whereby said hierarchical structure is changed in accordance with a requirement of an operator.

2. A method of editing moving images according to claim 1, wherein said step for determining said hierarchical structure has a step for generating a hierarchical structure management information file including display identification information for specifying representative still images to be displayed on said screen and information for designating a hierarchical relationship between said cuts and scenes constituting said moving images, and, in said display step, designated representative still images are displayed on a screen as a hierarchical structure based on the information of said hierarchical structure management information file including said display identification information.

3. A method of editing moving images according to claim 2, further comprising:

changing the hierarchical structure management information file by designating the representative still images on said screen showing said hierarchical structure and displaying the changed hierarchical structure on a screen.

4. A method of editing moving images according to claim 1, wherein said hierarchical structure further includes a plurality of frames relating to said selected cuts.

5. A method of editing moving images according to claim 4, further comprising:

changing coordinate positions on said screen of said representative still images displayed with said hierarchical structure so that said representative still images and said frames are displayed within a predetermined screen area.

6. A method of editing moving images according to claim 4, wherein in said step of displaying said hierarchical structure including said designated representative still images, both or either of the image representative frame in the frame images constituting said cuts and scenes and character information showing the contents of said cuts and scenes is displayed in said hierarchical structure.

7. A recording medium for storing program codes read and executed by a computer, comprising:

a first code section for inputting said moving images, said moving images including a plurality of scenes, each scene including a plurality of cuts and each cut including a plurality of frames;

a second code section for detecting change portions of said moving images and dividing said moving images into said scenes and cuts;

a third code section for selecting a still image representing each of said scenes and cuts;

a fourth code section for storing position information with respect to said change portions of said moving images and said representative still images of said scenes and cuts;

a fifth code section for designating said representative still images of said scenes and cuts to edit said moving images;

a sixth code section for determining a hierarchical structure, said hierarchical structure including at least a plurality of said representative still images of said scenes and said representative still images of said cuts relating to at least one scene selected from said scenes; and

a seventh code section for displaying an entire image of said hierarchical structure on a screen, whereby said hierarchical structure is changed in accordance with a requirement of an operator.

8. An apparatus for editing moving images comprising:

input means for inputting said moving images, said moving images including a plurality of scenes, each scene including a plurality of cuts and each cut including a plurality of frames;

detecting means for detecting change portions of said moving images and dividing said moving images into said scenes and cuts;

selecting means for selecting a still image representing each of said scenes and cuts;

a memory for storing position information with respect to said change portions of said moving images and said representative still images of said scenes and cuts;

means for designating said representative still images of said scenes and cuts to edit said moving images;

means for determining a hierarchical structure, said hierarchical structure including at least a plurality of said representative still images of said scenes and said representative still images of said cuts relating to at least one scene selected from said scenes;

a display for displaying an entire image of said hierarchical structure on a screen; and

a controller for controlling said detection means, said selecting means, said memory, said designating means, said determining means and said display so that said hierarchical structure is changed in accordance with a requirement of an operator.

9. A method of editing moving images comprising:

compressing said moving images and storing compressed moving images into a storage device, said moving images including a plurality of scenes, each scene including a plurality of cuts and each cut comprising a plurality of frames;

detecting change portions of said moving images and dividing said moving images and dividing said moving images into said scenes and cuts;

selecting a still image representing each of said scenes and cuts;

storing position information with respect to said change portions of said moving images and said representative still images of said scenes and cuts;

designating said representative still images of said scenes and cuts to edit said moving images and storing said representative still image of each of said scenes and cuts in a form of a reduced still image;

determining a hierarchical structure, said hierarchical structure including at least a plurality of said representative reduced still images of said scenes and said representative reduced still images of said cuts relating to at least one said scene selected from said scenes; and

displaying said reduced still images representing said scenes and cuts designated to edit said moving images in the form of an entire image of said hierarchical structure, wherein said hierarchical structure is changed in accordance with a requirement of an operator.

10. A method of editing moving images according to claim 9, wherein when an operator selects one of said representative reduced still images of said hierarchical structure, lower levels of said hierarchical structure related to said selected representative reduced still image are displayed while said entire image of said hierarchical structure is being displayed.

12. An editing apparatus for editing moving images comprising:

a video interface through which said moving images are supplied to the editing apparatus, said moving images including a plurality of scenes, each scene including a plurality of cuts and each cut including a plurality of frames;

a cut point detector, coupled to said video interface which detects change portions of said moving images, divides said moving images into said scenes and cuts and designates a still image representing each of said scenes and cuts;

a storage device which stores compressed image data corresponding to said moving images, change portion information with respect to said change portions of said moving images and a designated still image representing each of said scenes and cuts in the form of a reduced still image;

a processor for determining a hierarchical structure, said hierarchical structure including at least a plurality of said representative reduced still images of said scenes and said representative reduced still images of said cuts relating to at least one scene selected from said scenes;

a monitor which displays an entire image of said hierarchical structure on a screen; and

a control unit which controls said video interface, said cut point detector, said storage device, said processor and said monitor so that said hierarchical structure is changed in accordance with a requirement of an operator.

13. An editing apparatus for editing moving images according to claim 12, wherein when an operator selects one of said representative still images of said hierarchical structure, lower levels of said hierarchical structure related to said selected representative still image are displayed while said entire image of said

hierarchical structure is being displayed.